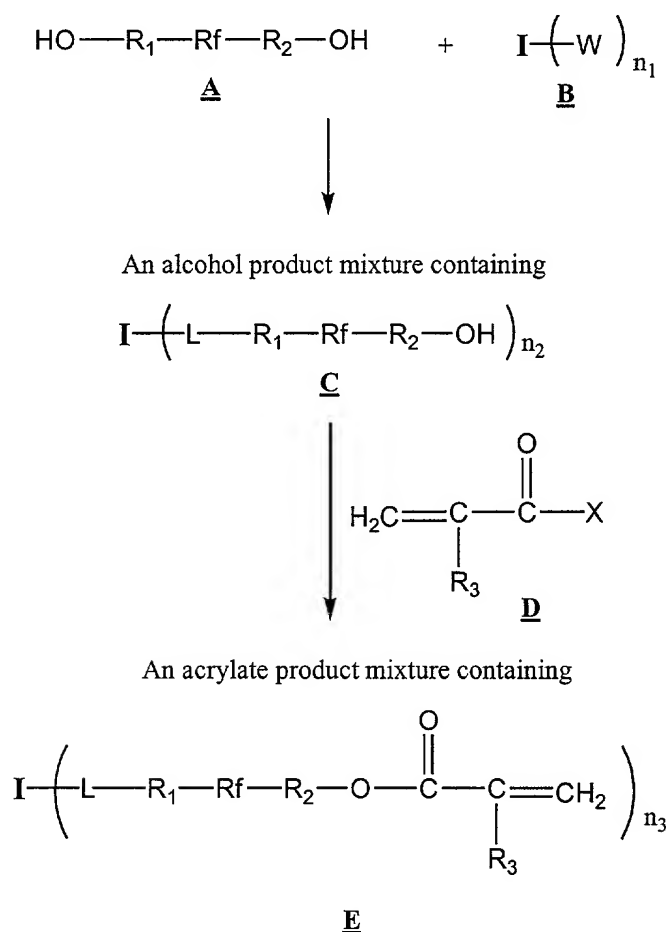


Claims

1. A photosensitive composition comprising:

- a) at least one fluorinated, non-urethane containing multifunctional acrylate prepared from at least one multifunctional alcohol, said alcohol being synthesized from a core molecule having at least two equivalents of hydroxy-reacting functional groups and a fluorinated molecule having at least two hydroxyl groups; and
- b) at least one photoinitiator.

2. The photosensitive composition of Claim 1, wherein the non-urethane containing multifunctional acrylate is prepared using the following reaction scheme:



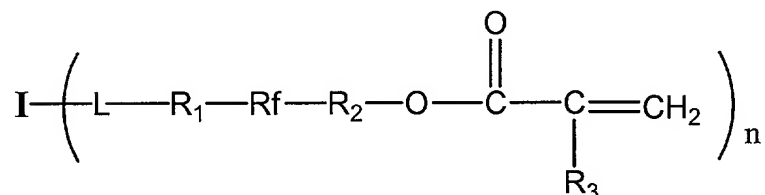
wherein **A** is a fluorinated monomer or polymer having two hydroxyl groups, wherein R_f is a monomeric or polymeric perfluorinated alkylenediyl, alkylene oxide, arylenediyl, arylene oxide, and mixtures thereof, and R_1 and R_2 are monomeric or polymeric divalent moieties such as alkylenediyl, alkylene oxide, alkylene sulfide, arylenediyl, arylene oxide, arylene sulfide, siloxane and mixtures thereof; **B** is a multifunctional molecule wherein **I** is a multivalent radical, W stands for one equivalent of hydroxy-reacting functional group and n_1 is at least 2; **C** is the multifunctional alcohol product mixture from **A** and **B**, wherein L is an ether or ester link and n_2 is at least 2; **D** is an acryloylation agent, wherein X is selected from OH, Cl and alkoxy; and **E** is the acrylate product mixture from **C** and **D**, wherein R_3 is H or CH_3 and n_3 is at least 2.

3. The photosensitive composition of Claim 2 wherein n_i ($i=1-3$) independently ranges from 3 to 6.

4. The photosensitive composition of Claim 2 wherein there are at least 2.5 equivalents of OH groups from **A** for every equivalent of hydroxy-reacting group, W , from **B**.

5. The photosensitive composition of Claim 2 wherein L is an ester link.

6. The photosensitive composition of Claim 2, wherein the acrylate **E** has the formula of:



wherein n ranges from 3 to 6.

7. The photosensitive composition of Claim 2 wherein R_f is a perfluorinated poly(methylene) moiety having at least 4 carbon atoms.

1 8. The photosensitive composition of Claim 2 wherein Rf is a perfluorinated
2 poly(alkylene oxide) moiety having at least 4 carbon atoms.

1 9. The photosensitive composition of Claim 2 wherein **B** is selected from a group
2 consisting of multifunctional carboxylic acid, acid chloride, ester and anhydride.

1 10. The photosensitive composition of Claim 2 wherein **B** is selected from 1,3,5-
2 benzenetricarbonyl trichloride, trimethyl-1,3,5-benzenetricarboxylate and 1,2,4-
3 benzenetricarboxylic acid.

1 11. The photosensitive composition of Claim 2 wherein **B** is selected from 1,2,3,4-
2 butanetetracarboxylic acid and tetraethyltrimethyl-1,1,2,2-ethanetetracarboxylate.

1 12. The photosensitive composition of Claim 1 wherein the acrylate has a number
2 average molecular weight of at least 500.

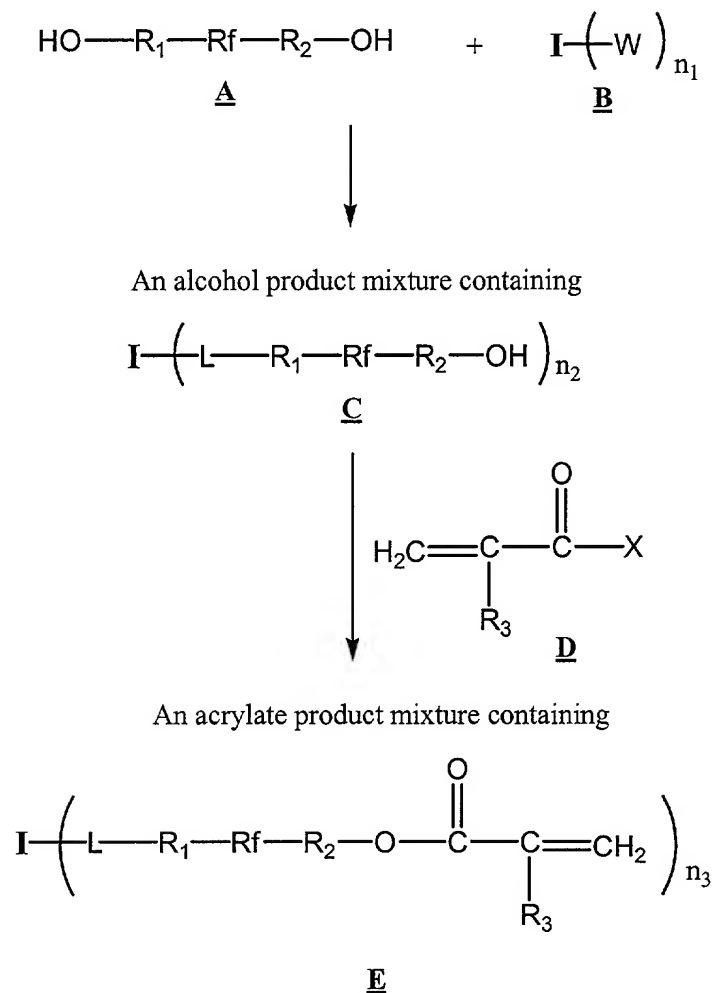
1 13. The photosensitive composition Claim 1 wherein the photoinitiator composition is a
2 mixture of at least two different photoinitiators.

1 14. A waveguide device having a light-transmitting structure formed on a substrate by
2 patterning the photosensitive composition comprising:

3 a) at least one fluorinated, non-urethane containing multifunctional acrylate prepared
4 from at least one multifunctional alcohol, said alcohol being synthesized from a core molecule
5 having at least two equivalents of hydroxy-reacting functional groups and a fluorinated molecule
6 having at least two hydroxyl groups; and

7 b) at least one photoinitiator.

15. The waveguide device of Claim 14 wherein the multifunctional acrylate is prepared using the following reaction scheme:



wherein **A** is a fluorinated monomer or polymer having two hydroxyl groups, wherein Rf is a monomeric or polymeric perfluorinated alkylenediyl, alkylene oxide, arylenediyl, alkylene oxide, and mixtures thereof, and R₁ and R₂ are monomeric or polymeric divalent moieties such as alkylenediyl, alkylene oxide, alkylene sulfide, arylenediyl, alkylene oxide, alkylene sulfide, siloxane and mixtures thereof; **B** is a multifunctional molecule wherein **I** is a multivalent radical, W stands for one equivalent of hydroxy-reacting functional group and n₁ is at least 2; **C** is the multifunctional alcohol product mixture from **A** and **B**, wherein L is an ether or ester link and n₂

11 is at least 2; **D** is an acryloylation agent, wherein X is selected from OH, Cl and alkoxy; and **E** is
12 the acrylate product mixture from **C** and **D**, wherein R₃ is H or CH₃ and n₃ is at least 2.

1 16. The waveguide device of Claim 14, wherein the waveguide structure is patterned
2 with an actinic radiation.

1 17. The waveguide device of Claim 14, wherein the waveguide structure is patterned with
2 reactive ion etching (RIE).

3 18. A thermo-optic device comprising a waveguide structure of Claim 14 and at least one
4 resistive heater.

5 19. The waveguide device of Claim 14 wherein said waveguide structure containing at least
6 one optical grating element.

7 20. The waveguide device of Claim 19 wherein said device comprising at least one resistive
8 heater.

1 21. A method to produce a waveguide device having a light-transmitting structure
2 formed on a substrate by forming a coating of a photosensitive composition on a substrate and
3 patterning the coating with an actinic radiation, said composition comprising:

4 a) at least one fluorinated, non-urethane containing multifunctional acrylate prepared
5 from at least one multifunctional alcohol, said alcohol being synthesized from a core molecule
6 having at least two equivalents of hydroxy-reacting functional groups and a fluorinated molecule
7 having at least two hydroxyl groups; and

8 b) at least one photoinitiator.

1 22. A method to produce a waveguide device having a light-transmitting structure
2 formed on a substrate comprising:

3 a) coating a layer of a first composition of at least one fluorinated, non-urethane
4 containing multifunctional acrylate prepared from at least one multifunctional alcohol, said
5 alcohol being synthesized from a core molecule having at least two equivalents of hydroxy-
6 reacting functional groups and a fluorinated molecule having at least two hydroxyl groups; and at
7 least one photoinitiator on a substrate and exposing the layer to an actinic radiation to form a
8 bottom cladding layer with a first refractive index, n_1 ;

9 b) coating a thin layer of a second composition of at least one fluorinated, non-urethane
10 containing multifunctional acrylate prepared from at least one multifunctional alcohol, said
11 alcohol being synthesized from a core molecule having at least two equivalents of hydroxy-
12 reacting functional groups and a fluorinated molecule having at least two hydroxyl groups; and at
13 least one photoinitiator on top of the bottom cladding layer and patternwise exposing the thin
14 layer to an actinic radiation through a photomask with a desired feature to form a latent image in
15 a core layer;

16 c) removing the non-exposed portions in the core layer with an organic solvent to form a
17 waveguide rib with a second refractive index, n_2 , wherein n_2 is greater than n_1 ; and

18 d) coating a thin layer of a third composition of at least one fluorinated, non-urethane
19 containing multifunctional acrylate prepared from at least one multifunctional alcohol, said
20 alcohol being synthesized from a core molecule having at least two equivalents of hydroxy-
21 reacting functional groups and a fluorinated molecule having at least two hydroxyl groups; at
22 least one photoinitiator on top of the core layer and the bottom cladding layer and exposing the

23 layer of the third composisiton to an actinic radiation to form a top cladding layer with a third
24 refractive index, n_3 , wherein n_3 is less than n_2 .

1 23. A waveguide device fabricated using the method of Claim 22.

1 24. The waveguide device of Claim 23, wherein $n_1 = n_3$.

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443
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